The Seybold Report on Word Processing

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AS WE ENTER the decade of the 1980s, we have decided to inaugurate yet another facet to *The Seybold Report on Word Processing*. Our traditional reports, where we cover individual systems in considerable detail, are something that we enjoy doing very much. And our *Buyers' Guides*, where we discuss how various products accomplish certain activities such as formatting considerations or typing technical documents, also give us great satisfaction. Naturally, we hope our readers welcome each issue as much as we enjoy preparing it.

With this month's issue we are introducing a new kind of report that we also intend to write on a periodic basis—a report that interprets how technological trends will affect word processing products and, quite importantly to our way of thinking, the people who use them. With the undertaking of this new series, we hope to draw further upon our own background and insight in a manner designed to bring these somewhat futuristic issues into focus, and thereby help our readers to understand some of the forces that are influencing events.

When we were in Chicago last year for the IWP Syntopican conference, we noticed that there were very few truly new products being introduced. The exhibits seemed to us to reflect an industry which was enhancing the capabilities of its existing products with additional features. In other words, it was primarily a period of consolidation.

In many respects, this consolidation probably was welcomed by the user community. This provided them some time to "catch up" with an industry that had been moving at a very fast pace. But we had expected more in the way of new events than we actually saw in Chicago. Perhaps we were led to anticipate too much because of the dramatic changes in both impact and electronic printing products that were on display in Los Angeles at the IWP Spring Symposium.

In any case, we were ready for more than the introduction of the new Vydec 2000 and 4000 series products—the latter as yet undelivered to the marketplace. But that expectation was unfulfilled. It then became apparent to us that next year's show, Syntopican VIII, would necessarily reflect a "break-out" period, where the next generation of products finally would get onto the exhibit floor and everyone would get his chance to "kick the tires" and take "test drives" on a new class of systems.

This seems consistent with the dawning of a new decade, the decade of the 1980s. Accordingly, we have decided to focus on some of the technological events that will influence future products. In fact, these products are already beginning to emerge and will continue to do so as time progresses.

And thus, we arrive with this month's issue entitled *Planners' Guide #1*. In the first half of the article we comment on the technological advances that will occur in the field of magnetic disk and magnetic bubble memory. And in order that these advances can be seen in their historical perspective, we elected to begin with a general background in floppy diskette technology, since it is one of the more significant building blocks out of which today's word processing systems are constructed.

Then, in the second half of the article, we offer personal comments on how this evolution in memory products will impact word processing products. For besides changes in hardware, changes in software must unavoidably be made if the introduction of such hardware is to achieve its zenith in utility to the actual user. Therefore, we further comment on the changes in file management that will be needed as a consequence of the incorporation of these new memory technologies.

Courtesy: INTEL CORPORATION

One of the more significant developments expected in the 1980s concerns the magnetic bubble memory (MBM) chip. This one inch square chip holds over one million bits or 128,000 characters of information. Information density is expected to go up, and the part costs are expected to come down to attractive levels.

PLANNERS' GUIDE #1

Memory Technology of the '80s

Current Floppy Disk Technology

During the 1970s, the floppy diskette established itself as the premier storage medium for virtually all stand-alone word processing systems. We have seen the introduction of two basic sizes of the "floppy," one being 8 inches in diameter and the other 5¼ inches in diameter.

Another significant difference is that not all manufacturers of floppy diskette drives employ the same design. Thus, within the two sizes mentioned, there exists a whole range of other differences: the number of bits stored per inch (*i.e.*, the *recording density*), the number of tracks per inch (*i.e.*, the *track density*), and the number of sides on which data are recorded.

From a user's standpoint, a byproduct of all this diversity is that these floppy diskettes, as used by the various system manufacturers, are *not* compatible. And even where different vendors' word processing systems in fact use the same diskette drive, the way in which information is stored is unique, so that floppies recorded on one vendor's system cannot be understood by another vendor's system.

So, before we describe what the 1980s will unfold in the way of new disk storage, we feel that a very brief primer in the current technology is worthwhile. And to simplify our task somewhat, we will focus on the various drives manufactured by Shugart Associates. Naturally, this should not be interpreted as an endorsement on our part of their particular products, since there are a number of manufacturers of diskette drives who also provide equipment to the word processing industry.

Even more important is the hope that the ensuing detail does not distract you from getting the overall perspective that we wish to convey. For those of you who are users of word processing equipment, as you follow our discussion of floppy diskette devices, perhaps you will subsequently amaze your coworkers with the depth of your knowledge in these matters.

The 1D-1S 8" floppy diskette. In terms of installed products, the single-density, single-sided (hence 1D-1S) 8" floppy diskette is the most common. In this product, data is written on one side only, leaving the opposite side completely empty. Using the Shugart SA-800 drive as an example (which is a *very common* drive in word processing equipment), the diskette drive rotates the diskette media at the rate of 6 revolutions each second. In what is commonly known as the "IBM Standard Format" (3741), the diskette is divided into 77 data tracks that are recorded 2/100 of an inch apart. And finally, each track is subdivided into 26 sectors of 128 characters, with the data in each sector being recorded at 3200 bits/inch (or 400 characters/inch). Therefore, each track contains 3,328 characters, and the entire diskette stores 256,256 characters of text.

But since the same physical diskette may be formatted differently by different vendors using the same disk drives, notice that AM and Xerox, among others, do not adhere to the IBM Standard Format. The AMtext 425 and the Xerox 850 Page Display divide each track into two sectors of 2,044 characters each, for a track capacity of 4,088 characters and a diskette capacity of 314,776 characters.

The 2D-1S 8" floppy diskette. The next level in diskette storage technology is the double-density, single-sided floppy diskette, which Shugart calls the SA-801. Still using only one side for recording data, it has the same characteristics as the SA-800 except that each sector is recorded at 6400 bits/inch rather than 3200 bits/inch, or twice the original density. Naturally, the length of each sector still is dependent upon the wishes of the word processing system vendor. In fact, one format divides each track into 26 sectors of 256 characters each. In this case, each track contains 6,656 characters and the entire diskette stores 512,512 characters.

1D-2S 8" floppy diskette. Predictably, there is the single-density, double-sided version which Shugart calls the SA-850. As its descriptive name implies, information is recorded on both sides of the diskette. Indeed, in most respects, it is the same as its cousin SA-800 unit. But because of engineering improvements, the SA-850 can move from one track to another more than twice as quickly as the SA-800, thereby resulting in otherwise unexpected performance improvements.

To date, very few word processing systems use double-sided diskette drives. Part of the reason for this is that virtually every diskette drive manufacturer experienced considerable difficulty in designing *reliable* double-density units, and the word processing system vendors properly developed a "wait and see" attitude before totally committing themselves to this generation of diskette drives.[1]

The 2D-2S 8" floppy diskette. And finally there is the double-density, double-sided version which Shugart calls the SA-851. This unit integrates all of the features present in the other units: a higher recording density, recording on both sides of the diskette media, and faster positioning of the read-write heads for more rapid access to the information.

WP systems use a range of 8" diskette products. Though still comparatively unusual, it is possible to identify word processing

1. For the curious, the engineering problem which had to be overcome was excessive wear of both the diskette media and the read/write heads that are positioned on opposing sides of the diskette. In order for data to be read from or written to the diskette, both heads are in contact simultaneously with the actual diskette media. Because the head on one side of the diskette is pressing against the head on the opposite side, excessive friction was occurring, thereby causing undesirable wear. Considerable effort on the part of diskette drive suppliers was required to overcome this engineering problem, resulting in major delays in upgrading word processing systems to double-sided recording.

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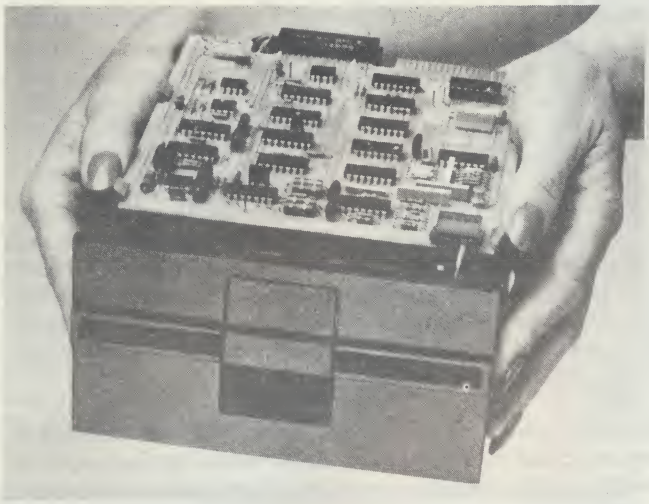
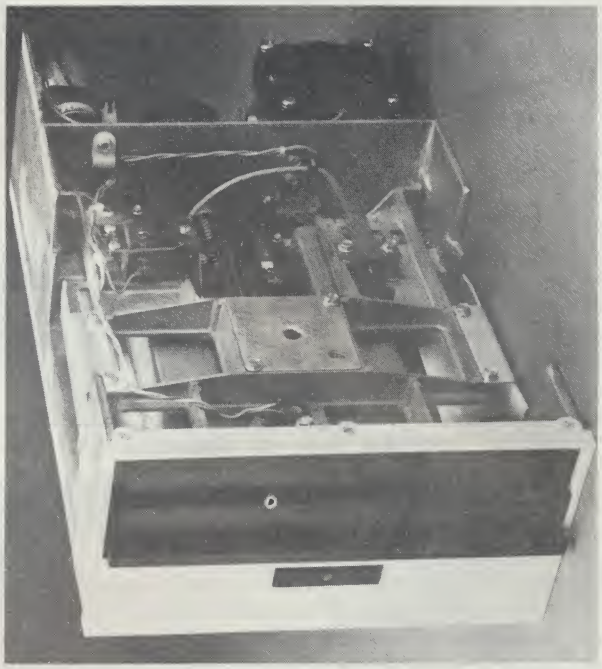


Courtesy: SHUGART ASSOCIATES

Floppy Diskette Drives

Right: A typical 8" floppy diskette drive. This unit is the Shugart Associates SA-800, which is a single-density, single-sided drive, and stores approximately 250,000 characters.

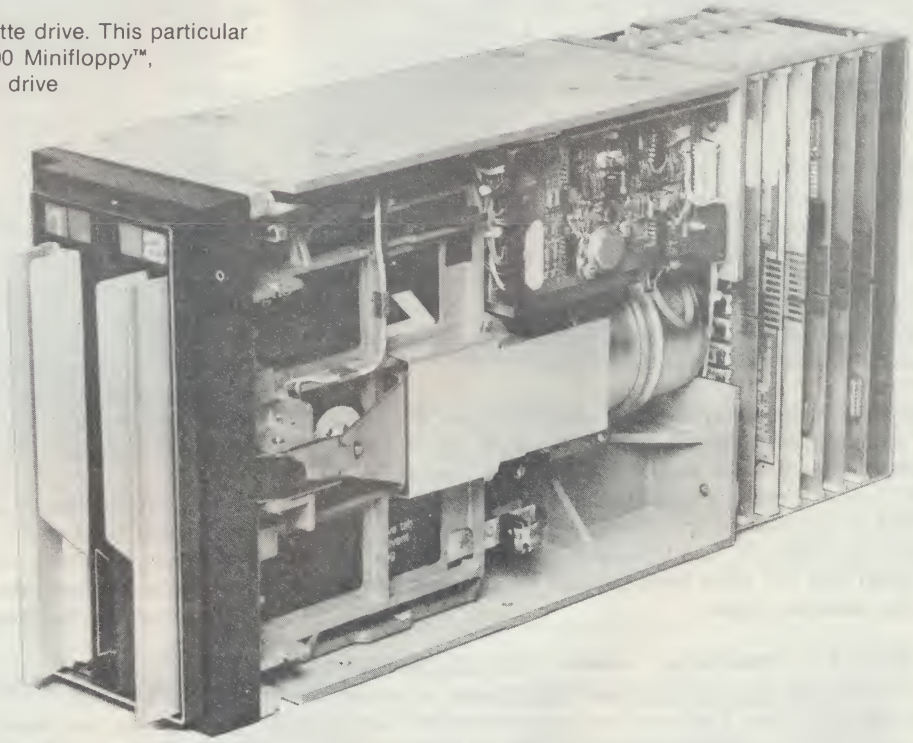


Courtesy: SHUGART ASSOCIATES

Above: A typical 5¼-inch floppy diskette drive. This particular unit is the Shugart Associates SA-400 Minifloppy™, which is a single-density, single-sided drive storing slightly less than 90,000 characters.

Right: This is the new Burroughs' MD-122 *dual* 8" floppy diskette unit featuring over three million characters of storage per drive, or 6 million characters per unit. A special outer sleeve protects the diskette media from damage. It is especially designed so that diskettes can only be inserted into or removed from the unit while the outer jacket is covering the media. Only after the diskette has been properly and completely inserted can its protective jacket be removed.

Courtesy: BURROUGHS OEM MARKETING GROUP



systems that can employ one of several different 8" floppy diskette units. Systems that provide such alternatives make it easier for the user of word processing equipment to combine the necessary editorial features with the appropriate amount of file storage.

By way of example, the shared-logic AM/Jacquard 100 offers 1D-1S diskette drives as its basic storage drive, and other higher-capacity rigid disks for more extensive on-line file storage. The "IBM Standard Format" is used, thereby yielding a storage capacity of 256,256 characters per diskette. Its brother, the AM/Jacquard J500 stand-alone word processing system, is normally equipped with 2D-2S diskette drives. In this case, each diskette stores 1,182,720 characters (2 sides of 77 tracks, with each track containing 15 sectors of 512 characters).

What Is a Bit?

In our different descriptions of the capacity of disk storage devices, we realize that describing the recording density in terms of *bits per inch* may not be understood by everyone. A "bit" is a binary unit of storage (*i.e.*, it can have only "states") which may be either ON (in which case it is a "1") or OFF (in which case it is a "0"). In order to represent a character, eight bits are often combined into forming what is commonly called a *byte*. Each byte may describe any one of 256 different characters or symbols depending on the binary values of its composite eight bits.

The newly announced Xerox 860 Information Processor may be configured with one of three different diskette products: the original Xerox 850 Display Typewriter and Page Display System 1S-1D units providing more than 300,000 characters of storage, the relatively rare 2S-1D unit providing over 600,000 characters storage, and the 2S-2D unit providing in excess of 1.2 million characters storage.

The 1D-1S 5¼" "mini-floppy" diskette. Though generally less popular than the 8" floppy diskette, the somewhat smaller mini-floppy diskette still has found a place in commercially available word processing systems. Most notably, the AES/Lanier No Problem uses the 1D-1S variety, and it provides a storage capacity of approximately 70,000 characters.

If you are comparing one word processing system with another, you should be aware that there are differences other than capacity between the standard 8" versus the 5¼" floppy diskette. Without knowledge of these differences, you cannot fully appreciate the consequences of choosing among various systems. For example, Shugart's mini-floppy drive rotates the diskette media at the rate of five revolutions per second. This is only 83% as fast as the 1D-1S standard floppy SA-800 unit. Therefore, even if the read/write heads are positioned on the proper track of the diskette, the word processing system must wait slightly longer for the proper sector to come around in order for data to be read from or written to the diskette. And the time required to move from one track to another is noticeably longer (in fact, it takes three times longer if the system is simply moving to the next track).

Each mini-diskette is divided into 35 tracks (as opposed to 77 tracks), but each track is recorded the same 2/100 of an inch apart. Typically, each track is formatted into 10 sectors of 256 characters each. But the information in each sector is recorded at a lower density: only 2,581 bits/inch rather than 3200 bits/inch. Because of this, each track stores 2,560 characters, and the entire diskette contains 89,600 characters assuming that this particular format is used.

Word processing system manufacturers who have adopted the 5¼" diskette units have chosen to overlook its restrictions because an SA-400 mini-floppy drive costs less than an SA-800 8" unit. Interestingly, one usually cannot perceive significant differences in the retail price of products that use the mini-floppy versus those that use the standard floppy. However, we must not forget that the retail price includes things other than the cost for hardware alone.

The 2D-1S 5¼" "mini-floppy" diskette. Naturally the SA-400 has a brother SA-401 unit that records information at twice the density of the former. There are several ways in which vendors may format it. One method simply doubles the length of each sector to 512 characters. In contrast, the Burroughs Redactor II (now known as the System 240) happens to use a 2D-1S mini-floppy formatted with 16 sectors of 256 characters each. Therefore, each track contains 4,096 characters and the entire diskette stores 143,360 characters.

The 2S-1D 5¼" "mini-floppy" diskette. To our knowledge, there are no word processing systems that use the double-sided, single-density mini-floppy diskette unit. Interestingly, the recording characteristics of the SA-450, which is just such a 2S-1D unit, are slightly different from its cousin 1S-1D SA-400.

Specifically, the density is increased from 2,581 bits/inch to 2,728 bits/inch, and it is sometimes formatted in 18 sectors of 128 characters each. Therefore, each recording surface of the mini-floppy diskette contains up to 80,640 characters, for a total capacity of 161,280 characters. In most other respects, its general characteristics are the same as those of the single-sided mini except for the physical construction with recording heads on each side of the media.

The 2S-2D 5¼" "mini-floppy" diskette. Known as the SA-451 in the Shugart diskette product line, the principal improvement in the 2D-2S unit is that information is recorded at 5,456 bits/inch, and each track may be formatted into 18 sectors of 256 characters each. When this is done, each track contains 4,608 characters and each side of the diskette contains 161,280 characters.

Burroughs uses a 2S-2D diskette unit in its newer Redactor II machine called the System 250. As formatted by Burroughs, it provides almost 300,000 characters of storage per diskette.

Floppy Diskettes in Perspective

From this review of the current technology in floppy diskette units, one can see that there really is more available than we sometimes have occasion to remember. Not all of these various units have actually been incorporated into actual word processing systems, but the range of products is impressive nonetheless. And, of course, all of these units were not manufactured from the very beginning. Rather, they have evolved over the course of the last half of the 1970s, some of them only after considerable engineering difficulties were surmounted.

But from our discussion we can observe that the 5¼" mini-floppy diskettes have sacrificed various elements affecting performance in favor of lower manufacturing costs. Their evolution is such that about 300,000 characters of information can be stored on a 2D-2S floppy, which is equivalent to the capacity of the commonplace 1S-1D 8" floppy diskette.

In turn, the standard 8" floppy diskettes have themselves undergone their own evolution. Initially providing between 250,000 and 300,000 characters of storage, they now offer over 1 million characters capacity in the newer 2D-2S versions.

Can we surmise that we are at the end of the engineering and development cycle of the floppy diskette? After all, other disk technologies (which we will discuss quite soon in this article) are becoming available in the word processing marketplace that may overshadow the floppy diskette.

Emerging High-Capacity Floppy Diskettes

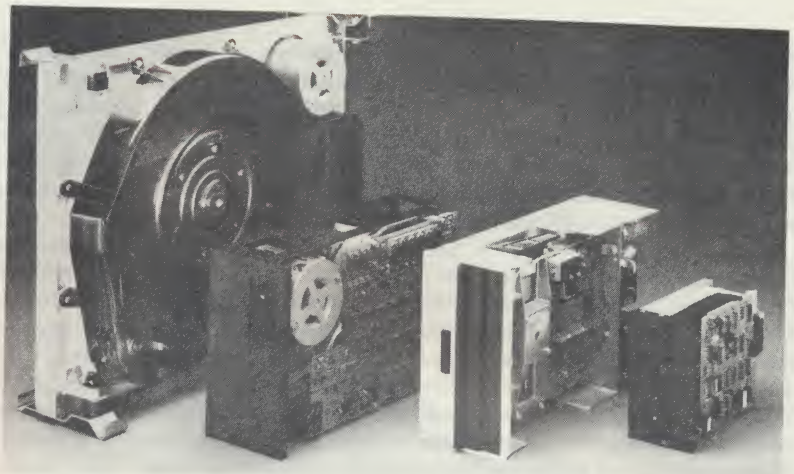
The answer to our previous question appears to be that the floppy diskette is not necessarily ready to yield (at least willingly) its pre-eminence in the marketplace. In the fourth quarter of last year, the Burroughs OEM (original equipment manufacturer) Marketing Group unveiled a dual 8" floppy diskette drive, the MD-122, which stores 3 million characters on each of its two drives.

Burroughs expects that evaluation units will be available in the first quarter 1980, with the first production units delivered in the third quarter 1980. The MD-122 is scheduled for use in its new B90 small business computer systems. No announcement has been made since then as to when or whether it woud be incorporated into the Redactor Series word processing product line, though one can only wonder why it would not eventually become available in some upgraded system.

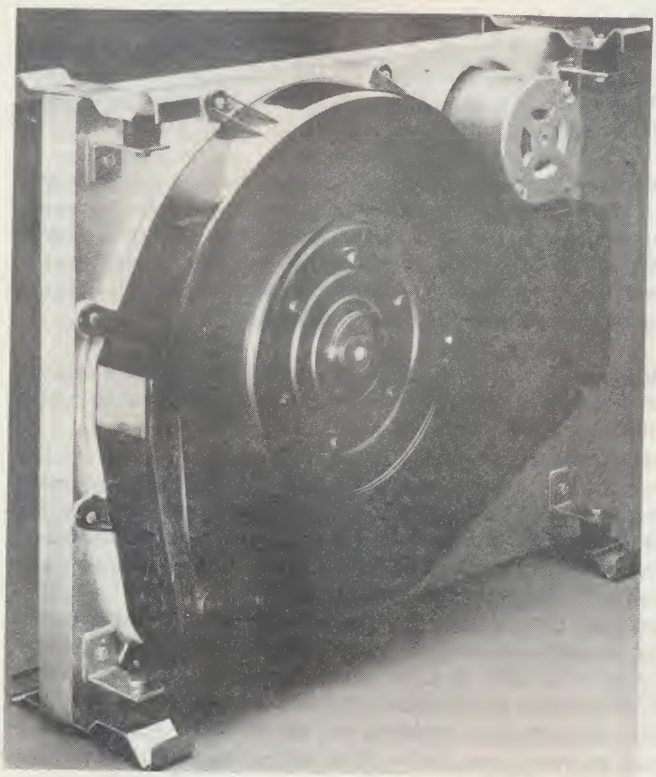
Winchester Disk Drives

Right: This is Shugart's complete family of low-cost fixed and floppy disk units. Left to right: the SA-4000 14" Winchester fixed disk drive, the SA-1000 8" Winchester fixed disk drive, the SA-851 8" double-sided floppy disk drive, and the SA-400 5¼" floppy disk drive.

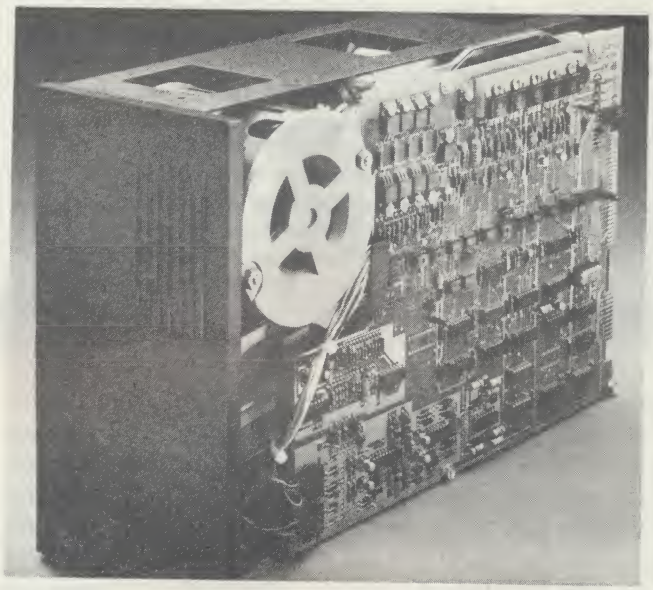
Below: A closer picture of the SA-4000 14" Winchester disk drive manufactured by Shugart. Depending upon the model, either 12.4 or 24.8 million characters can be stored on each drive. Information can be transferred at the rate of 7.1 million bits/second, which is considerably faster than the SA-800 (250,000 bits/second) or the SA-400 (125,000 bits/sec.).



Courtesy: SHUGART ASSOCIATES



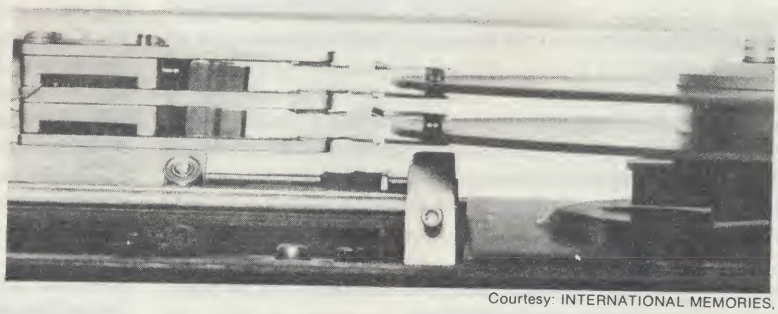
Courtesy: SHUGART ASSOCIATES



Courtesy: SHUGART ASSOCIATES

One of the newer generation Winchester drives, this SA-1000 can store either 4.2 or 8.4 million characters given a 256-character sector size. Its transfer rate is 4.34 million bits/second, or approximately 60% as fast as the bigger SA-4000 and more than 1700% faster than the SA-800 8" floppy disk drive. It is designed to fit in the same rack mountings as its brother SA-800, which is so extensively used in many of the word processing systems available today.

Courtesy: INTERNATIONAL MEMORIES, INC.



Courtesy: INTERNATIONAL MEMORIES, INC.

Left: International Memories, Inc. is one of the pioneers in producing 8" Winchester disk drives. The Model 7710 shown here can store up to 11.3 million characters of information. Data is recorded in 350 tracks that are 33/1000 of an inch apart (300 tracks/inch) at a recording density of 5,868 bits/inch. The two 200-millimeter-diameter disks inside the unit revolve at 3,600 rpm, and data is transferred at 5.184 million bits/second.

Above: A close-up of the IMI 7710 showing the recording heads positioned over the two disk platters. Another model, the IMI 7720, stores up to 20.5 million characters on *three* 200-millimeter-diameter disks.

By way of comparison with the current generation of floppy diskettes, it rotates the diskettes at the noticeably higher speed of 8.733 revolutions per second, and it records data at a remarkable 7,100 bits/inch. The diskettes contain 139 tracks per side (double-sided recording), with each track separated by less than 7/1000 of an inch (150 tracks/inch). Every track holds 44 sectors of 256 bytes, for a track capacity of 11,264 characters.

Even at this early stage, some important conclusions can be drawn about this new generation of 8" floppy diskettes. Of particular significance is that this technology represents impressive capacity, and yet it retains the virtue of small, flat diskette media that can be *easily removed* from the word processing system one after another and another quickly loaded for access to other stored files. With these features (high capacity, higher access speeds, and convenient removability) integrated into a single product, the utility of the floppy diskette is considerably extended beyond what would otherwise be expected, and no one should underestimate the potential impact of such developments.

Winchester Rigid Disk Technology

Up to this point, we have confined our discussion to *removable* diskette units. In various multi-terminal word processing systems, files may be stored on removable or non-removable "rigid" disks that permit a wider range of storage capacities. Wang, to mention just one word processing system vendor from the many in the market, offers its customers the following assortment of basic storage configurations:

System	Storage
WPS 25 Model 1	1,250,000
WPS 25 Model 2	2,500,000
WPS 25 Model 3	5,000,000
WPS 30	10,000,000
OIS 130	10,000,000
OIS 140 Model 1	26,800,000
OIS 140 Model 2	53,600,000
OIS 140 Model 3	80,400,000

You will note that the Burroughs "Superfloppy" (if we may call it such) overlaps in capacity with the rigid disk storage used in the Wang 25 series. Worthy of note is that the Wang systems include a single floppy diskette drive so that files may be archived off-line and subsequently loaded on-line when needed. In the case of high-capacity floppy diskettes, however, they inherently provide a removable media capability and do not require another device for that function, thereby resulting in a lower basic cost.

In any case, it often has been impractical in the past to consider dedicating such non-removable storage devices to stand-alone word processing systems because the cost of doing so would tend to discourage customer interest except for very unusual situations.

There is, however, an emerging generation of rigid disk devices that will change all our preconceptions.

14" Winchester sealed disks. These particular units, though not strictly new devices, are not as well known by word processing system users as the ubiquitous floppy diskettes. Therefore, we think that a brief description of their characteristics is appropriate so that you can compare them with that of diskettes.

First of all, they are rigid rather than flexible and are completely sealed inside a housing so as virtually to eliminate any possibility of contamination with dust, dirt, smoke or other contaminants. Because the disk is free of such harmful particles, the recording heads may skim quite close to the surface. This results in a fairly high storage capacity.

Again taking the Shugart Associates product line, their SA-4004 spins the disk, not at 5 or 6 revolutions per second, but at over 49 revolutions per second. This faster rotation dramatically reduces the amount of time one waits for the desired sector to move into position under the recording heads. The obvious conclusion is a markedly-improved performance in any word processing system incorporating such a device. As such, they are certainly useful in systems having clusters of terminals.

The disk contains 808 tracks that are divided between two sides of one disk platter. Each track, separated by less than 6/1000 of an inch (172 tracks per inch), is further subdivided into 60 sectors of 256 characters each. And the data is recorded at a density of 5,534 bits/inch. Thus, each track contains 15,360 characters, and the entire disk stores 12,410,880 characters.

Predictably, there is a companion unit called the SA-4008, and it is identical to the SA-4004 in all respects except that two platters are used instead of only one, thereby achieving a total capacity of 24,821,760 characters of storage. Shugart is currently working on still another model that will further increase the storage to over 49 million characters (formatted).

Of special interest is the optional capability of having 8 recording heads permanently mounted over 8 tracks of the disk. These additional recording heads are *independent* of the normal recording heads that are positioned as needed to the appropriate track for reading or writing data. In this way, a maximum of 122,880 characters of information (such as the file directory of the entire disk, or even segments of the word processing software not always contained in the system's main memory) stored beneath these stationary heads can be rapidly accessed without affecting the position of the moving heads that are accessing user files.

8" Winchester sealed disks. While the larger 14" Winchester disks are certainly interesting, the new 8" Winchester disks will have an even more profound impact on the kind of word processing systems that we will see in the near future.

But before we get ahead of ourselves, we should describe how the 8" variety differs from the 14" kind. Designed to rotate the disk at over 52 revolutions per second, the 8" SA-1002 records data on 256 tracks on each side of the platter. The track density is the same as the SA-4000 series units. Within each track are 32 sectors of 256 characters written at a recording density of 6,270 bits/inch. Thus, each track contains 8,192 characters, and the entire disk stores 4,194,304 characters of data.

And, finally, there is a companion unit called the SA-1004 that uses two platters to provide the doubled capacity of 8,388,608 characters of storage.

One must remember that the physical dimensions of these units are the same as that of the standard 8" floppy diskette drive. Because of this, systems that have *two* floppy diskette drives (with each providing perhaps 250,000 characters of storage) can replace one floppy diskette drive with one of the new 8" Winchester drives capable of either 4.2 or 8.4 million characters

About Other Rigid Disks . . .

In our discussion of rigid disk drives, we have not given the same historical background in their evolution as we have for the floppy disk drives. The reason for this is that rigid disk drives from many different manufacturers are used in the current generation of multi-terminal word processing systems, and we didn't feel that there would be adequate space to discuss them in the same detail.

Instead, we have devoted most of our attention to the new generation of Winchester disk drives that will be incorporated into word processing systems that are already announced or will be in the future. This in no way minimizes the contributions of the other rigid disk drives that are incorporated in the word processing systems currently being delivered.

For readers who are curious about other rigid disk drives, two articles in the regular *Seybold Report* (Volume 6, Number 24, and Volume 7, Number 1, both published in late 1977) offer an extensive description of all random access disks being manufactured at that time. These reports focus on how those disk drives have been used with systems sold to newspapers and the graphic arts community, but they still contain a great deal of interesting information. To inquire about ordering those reports, please call Seybold Publications at (215) 565-2480.

storage. The remaining floppy diskette drive can be used to archive files off-line and to reload them when needed.

The recently-announced Xerox 860 Information Processor offers the customer the choice of either of these 8" Winchester drives, thereby markedly increasing the amount of on-line storage associated with a traditionally stand-alone word processing system.

5¼" mini-Winchester removable disks. Though the 8" Winchester disks are still very new, news of yet another generation of Winchester disks ranging in size from 4" to 6" is thrusting itself upon us. These "mini-" Winchester units probably will feature *removable* (either rigid or perhaps even floppy) disk modules with capacities of 1+ million characters.

Advances in the design of the recording heads and the packaging of the disk media will ensure that removable media can be free of contamination. And since it will be possible to use newer methods for applying the magnetic material to the surface of the disks (relatively thick coatings of magnetic ferrite oxide probably will be dropped in favor of thin films only a few molecules in depth), the recording density may be increased to as much as 10,000 bits/inch in the near future. As a consequence, Winchester disk technology will significantly alter the look of word processing systems.

'Megadisk' Drives in Sight

We have hardly begun to assimilate fully the Winchester disk technology into our word processing products, and yet there is still much more that will be happening within the next five years. In the data processing community, for use in conjunction with fast mainframe computers running many applications simultaneously, high-capacity disk drives are already commonplace. For example, the Memorex 3652 disk drive has a rated storage capacity of 317.5 million characters. Data is recorded at 6,359 bits/inch, and each track is separated by barely more than 2/1000 of an inch (actually 486 tracks/inch).

However, disk manufacturers are planning to switch from disks coated with magnetic oxide measuring 36 one-millionths of an inch in thickness to disks sprayed with magnetic films of only 4 one-millionths of an inch. The result will be a veritable revolution in disk storage capacity.

But if we may briefly return to the Memorex 3652 drive, each square inch of the magnetic oxide surface stores 3,090,474 bits.[2] With use of thin-film technology, Memorex expects to see this density ultimately increased to 50 million bits per square inch of disk surface, or more than 16 times greater than their current product. An imminent increase of the track density to over 600 tracks/inch will contribute toward this objective.

Just contemplate for one moment: one square inch of a thin-film disk will store as much data as would require about *two hundred* 1D-1S floppy diskettes. Put in other terms, that same square inch will store 2,500 pages of 2,500 characters each or, if you prefer, half that many pages containing 5,000 characters each. Remarkably, Memorex expects this technology to be available by 1982.

Product	Bits per sq. inch	Density factor
SA-400	123,388	.8033
SA-450	130,944	.8525
SA-800	153,600	1.000
SA-850	153,600	1.000
SA-401	247,776	1.6131
SA-451	261,888	1.7050
SA-801	307,200	2.000
SA-851	307,200	2.000
SA-4004	951,848	6.1969
SA-4008	951,848	6.1969
MD-122	1,065,000	6.9335
SA-1002	1,078,440	7.0211
SA-1004	1,078,440	7.0211
Memorex 2652	3,090,000	20.1172
Memorex "Mega"	50,000,000	325.5208

Table 1. Comparative storage density of disk products (using the prevalent SA-800 as the baseline product).

Bubble Memory Technology

Before we launch into a discussion of how the various pieces of the changing memory technology puzzle fit together, we need to describe some developments in areas other than disk technology. Many companies (the likes of such corporate giants as Bell Laboratories, IBM, Intel, Rockwell, Texas Instruments, not to mention the Japanese firms of Fujitsu, Hitachi, and Nippon Electric) are in another race to develop economical chips of magnetic "bubble" memory (MBM).

What, you may ask, is "bubble" memory? Not surprisingly, it is not made by mixing detergent with water. Instead, it is a tiny, *non-volatile*[3] mass storage device made from a synthetic garnet. Information is stored in the form of magnetic fields measuring a

2. This figure was determined by simply multiplying the number of bits per inch by the number of tracks per inch, or 6,359 times 486.

3. Non-volatile means that the magnetic bubbles which are encoding or carrying the data will continue to do so even without being refreshed by electrical power. Hence, they are insensitive to power failure.

few millionths of an inch in diameter, though they have the appearance of liquid bubbles when viewed under extreme magnification.

In contrast with disk technology, bubble memory is completely electronic and requires no moving mechanical parts. To physically access information stored in a MBM, one should visualize the extremely small magnetic bubbles as flowing across the surface of the garnet crystal toward signal detectors so that the bubbles can be read. Recalling the on/off concept of conventional memory, where a magnetic field determines whether a binary "1" or binary "0" is present, the presence or absence of the bubble itself (*i.e.*, a magnetic field in the form of a small bubble) represents the binary "1" or binary "0" information.

Interestingly, different methods of constructing and operating such MBM's are being explored by the various companies in the hope that relatively low manufacturing costs can be achieved —a price of 20 to 25 cents per thousand characters is one objective that is occasionally mentioned.

In 1977, Texas Instruments was first to offer a bubble memory device that stored 92,000 bits. Last year Intel became the first to offer a chip having one million bits, which is slightly more than 131,000 characters of storage. TI recently announced versions providing one-fourth, one-half and one million bits each. In terms of future developments, Bell Laboratories already has an experimental chip that stores one million characters in 1.3 square inches.

Indeed, it appears that the rate at which the capacity of bubble memory chips will be increased is going to be dramatic. If one were to predict this rate by using, as a guideline, our past experience with the rate at which other memory technologies have increased in capacity, we should expect to see bubble memory capacity quadrupled every two years. Remembering that 1979 brought chips of one million bits each, from this one might predict that 1981 will bring forth chips of four million bits, 1983 will bring chips of 16 million bits, and so on. The numbers become truly amazing.

As confirmation of this, IBM predicts that we will shortly be able to store 25 million *characters* in bubble memory chips one inch square.

256K Bit 'RAM' Chip Technology

And finally, yet another memory technology that is rapidly evolving is that of the RAM chip. For those who are not familiar with the term "RAM," it stands for "random access memory." Not to be confused with disk memory or bubble memory, RAM chips are used to provide word processing systems with high-speed internal working memory in conjunction with the microprocessor chip that performs the various editing and formatting functions. When we write about a certain word processor loading its software from a system diskette at power-on time, it is being copied into the RAM memory of the system.

As such, it is an integral part of every system offered today. Because of the limitations in the storage capacity of the RAM chips available today, numerous RAM chips are needed to form the entire complement of internal memory of the system. Indeed, if you currently have a word processing system installed, it is probably constructed with chips having no more than 16,384 bits each (*i.e.*, 2,048 characters).

Since it is becoming quite common to find systems having 64,000 characters of internal memory for holding the actual software program, along with the various display and disk buffers needed by the program to function properly, you can see that quite a few individual RAM chips are required.

Recently both the Nippon Telephone and Telegraph's Musashino Electrical Communication Laboratory as well as NEC-Toshiba Information Systems are claiming to have RAM chips containing 262,144 bits (*i.e.*, 32,768 characters) each. Though probably several years away from economical production, memory chips such as these will permit system designers to configure a large amount of internal memory in a very small space.

As a result of such improvements, the sophistication of word processing systems can be dramatically increased while keeping their physical size remarkably small and their manufacturing costs quite low.

The Impact of Word Processing Products

Given the development of such a dazzling array of both disk and memory technologies, everyone will have to revise and expand the way in which they perceive of word processing systems solving application needs. In this regard, we would like to focus on several areas where we feel the impact of these technologies will be most profound.

Stand-alone systems for long documents. Until now, the use of stand-alone word processing systems for the production of long documents has been hampered primarily by two limitations. The first involves the restrictions imposed by equipment. In most cases, stand-alone word processing systems are quite limited in their total capacity of on-line file storage. As we have mentioned elsewhere in this article, the "typical" system often provides something like 250,000 characters of storage on each of its single-density, single-sided 8" diskettes. Because of this relatively small capacity, an organization preparing lengthy reports or legal documents may be compelled into installing a multi-terminal system because of its more generous pool of on-line file storage. Given certain circumstances, however, a single operator may be more than adequate to handle the intended workload, thereby making it difficult to cost-justify a larger system.

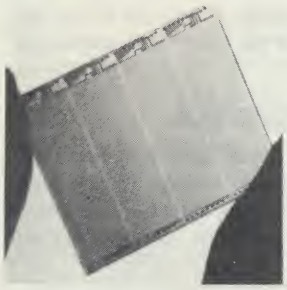
The other involves the restrictions imposed by financial or political rather than technical considerations. In smaller organizations or in independent departments within larger organizations, budgetary constraints may make it impossible to install any equipment more expensive than a stand-alone system. The need for the larger file storage associated with a multi-terminal system results in an expenditure that is out of proportion with that organization's ability to pay for it. The group is then confronted with the choice of paying too much for a word processing capability or of doing without it entirely.

On the other hand, given the imminent introduction of either high-capacity floppy disk or economical Winchester disk drives, more cost-effective solutions will be possible. A user needing a stand-alone system with between 5 and 10 megabytes of storage will be able to have one within affordable cost constraints.

Small cluster systems sharing disk storage. Besides providing a stand-alone word processing system with more extensive on-line file storage, Winchester disk technology will benefit those users who would like to install a system having a small number of terminals and sharing perhaps ten to twenty million characters of file storage.

Courtesy: INTEL CORPORATION

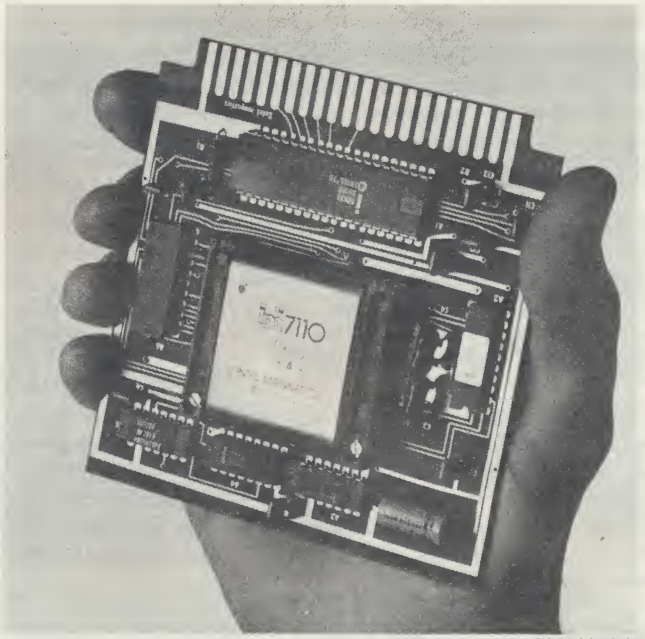
Magnetic Bubble Memory



Courtesy: INTEL CORPORATION

Left: On this chip manufactured by the Intel Corporation, more than one million bits of information can be stored. The memory is approximately 1" on each side.

Above: This bubble memory chip has been surrounded by its protective jacket, which is designed to shield it from other electromagnetic fields that might be near when installed in a system.



Courtesy: INTEL CORPORATION

Here you can see the Intel Magnetics IM 7110 one-megabit bubble memory mounted on an interface board.

Such a configuration would permit several operators to simultaneously edit different portions of large documents, thereby reducing the elapsed time necessary to integrate all revisions to a common document. The last minute crunch to get the final version of the document completed would be greatly relieved given such a capability.

Or the same system would permit several operators to be working on totally unrelated jobs while sharing both the hard-copy printer and the file storage. Just a few operators would be able to handle a considerable amount of work from a larger community of people who are primarily responsible for originating written material. In fact, this kind of system would be ideal for small firms where the principals desire to enhance their own productivity through personal use of word processing tools.

Dual role systems. Yet another application of the same technology involves a common system suitable for the small business needing both a business data processing as well as a word processing capability. A small business often will find it useful to have a system capable of handling a small payroll, accounts receivable and payable, and so forth. In many cases, there is the additional need for record processing capabilities to be used in preparing promotional mailings and other general correspondence. Given the limited financial resources of the small business, however, installing one system which provides both functions is clearly preferable to installing separate machines to perform each function so long as one machine is adequate in all other respects.

Because of the amount of information that is likely to be processed, a dual-capability system should have an absolute minimum of several million characters of on-line file storage, with the ability to double and quadruple this capacity as the business grows larger. Hence systems that incorporate Superfloppies or Winchester disks are better suited to satisfying this particular market than most of today's systems.

Information processing systems. Conceptually, it may be only a short step from this dual-role DP/WP system to what might be called the "information processing" system, but that transition rarely can be accomplished easily by systems available today.

From a historical perspective, the fact that fully-featured information processing systems do not truly exist today is not so puzzling if one remembers that data processing and word processing systems evolved separately. The initial use of general-purpose computers for business and scientific data processing resulted in the development of certain suitable software tools and data processing techniques. The subsequent use of computers for word processing resulted for the most part in a different set of tools and techniques.

As an example, the sequential processing of a file in a data processing context involves starting at the front of the file and proceeding through toward the end of the file. This is perfectly logical, and there is no apparent need to process a sequential file beginning at its end and moving forward toward the front. In those instances where there is a practical requirement for this, the data processing system approach would be first to sort the records of the original file into reverse sequence, and then to read that sorted file sequentially in the conventional front-to-back manner.

If one were to switch into a word processing context for a moment, one might conceptualize a document as also being sequential in nature and something through which one scrolls under operator control, possibly making revisions as one goes along. But how does one scroll backward through a sequential file given the data processing notion of file management? From this it can be seen that file management software which is perfectly adequate for the data processing environment is not necessarily adequate for the word processing environment.

Independently, we know that it is technically feasible to have common file management techniques that are suitable for both applications. In fact, what is needed is the concept of a file that is an ideal mixture of both forward and backward sequential access structure that is integrated with a random access structure for ease of updating as well as jumping to different pages. And when the manufacturers produce systems having such capabilities, thereby permitting data processing programs and word processing programs to access a unified file structure, then a significant milestone in providing multifunctional or information processing systems will have occurred.

Corporate communication systems. Some people choose to designate this category with a flashier name such as the "office of the future" or "automated office" system. We prefer to use the more bland designation of "corporate communication" system because it reflects the root concept.

In such an environment, many levels of personnel will be direct users of such a system. No longer will use of word processing equipment be confined to certain trained specialists. Instead, a broad community of users will use equipment in their daily work, work which might generally be thought of as processing information in one form or another.

If word processing equipment today is used to prepare documents for distribution either inside or even outside the originating organization, then using systems with the appropriate capabilities to facilitate such distribution is the next logical step. We intend to cover in a separate article those changes in the telecommunications field that will have a direct bearing on this development.

But as far as this *Planners' Guide* is concerned, the continued development of both disk and memory technology is absolutely vital to the successful accomplishment of the "total office" corporate communications system. Without the development of disks with immense capacity, the rate at which we proceed toward pervasive automation will be significantly hampered.

And the reason for this is almost too obvious to mention: the amount of information in the form of documents flowing through the distribution channels and residing within the filing cabinets of a large organization is almost overwhelming. If advanced capability systems are to have anything other than a minor impact on the way in which the office functions, then *immense* file storage capacities are necessary.

Indeed, the "paperless" office can only function satisfactorily if the uses for paper are virtually eliminated, and that cannot happen overnight. But it is possible, given the continual development of ever larger file storage devices, to alter significantly the way in which the traditional office functions, and that will happen on a gradual basis.

Multi-tasking systems. During the time when many of these changes will be going on, another cross current will be proceeding in parallel: it will become commonplace to see machines that are capable of performing many tasks at the same time. For many readers, this notion initially may sound strange, but don't be disquieted by this.

Actually, at a rudimentary level, even some of today's stand-alone word processing systems incorporate the notion of doing different things at the same time. For instance, if your system can be printing out one document while you are revising another, then you have a rudimentary *multi-tasking* system. In a few systems, it is even possible for the system to be transmitting or receiving files over a communication link at the same time that other activities are occurring.

On the other hand, one should not underestimate the burden placed upon a system which is trying to accomplish this feat. Given floppy disk drives, which cannot move from one area of the diskette to another with great speed or cannot transfer the information particularly fast once the read/write heads are properly positioned, the burden of simultaneously trying to read one file for printing, to write another file being received from a remote system, and to update still another file with editorial revisions is often too much to accomplish while trying to conceal from the user some degradation in one or more of these activities.

To perform comfortably numerous tasks at the same time, the system should possess certain characteristics. The first of these is that a generous amount of high-speed working or main memory is needed. The high-capacity RAM chips which we mentioned will make it possible to have copious amounts of main memory at an affordable price. The second of these is that higher-performance Winchester disk drives will greatly facilitate responsive access to numerous files. And, lastly, these same disk drives will provide more on-line storage so that the user is not continually switching floppy diskettes in and out of the system, which would otherwise distract the user from more productive work.

The Impact on File Management

Not surprisingly, systems having the capabilities which we have described also imply other technological changes that we have not mentioned heretofore. Since we are writing about storage technologies, we should discuss the relevant changes that will occur because of these newer devices.

Perhaps the most fundamental change involves the need for more sophisticated file management systems. The kind of directory or index that is common on today's stand-alone word processing system may seem adequate given its limited on-line storage capacity, but the introduction of Winchester disks having 5, 10, even 20 million or more characters of storage force one to reconsider what is acceptable.

The one-level directory. The "typical" directory is designed to reflect, in a single list, those files that are stored on a particular floppy diskette. If you wish to have certain files grouped together, to the exclusion of all others, what you are required to do is quite simple: on each diskette, only store those files that are related to one another. Then, whenever you want to access one of these files, you simply load that particular diskette in your system and begin working.

Of course, certain difficulties arise when you want to access several files which may be individually stored on different diskettes. Given this situation, the only workable procedure requires the juggling of diskettes in and out of the system as they are needed. Other people would probably look upon this situation as one of the pragmatic limitations of any system, and supposedly one should be content to overlook it as much as possible.

But when you consider having a stand-alone system with 10 million characters of on-line storage (or more than 40 times that of the 1S–1D floppy diskette), then there is sufficient cause to re-evaluate the advisability of such a simple file management system. If this is not reason enough to reconsider, take the case of a Winchester disk that is shared by a small cluster of workstations. Is it appropriate for you to have to wade through the names of files belonging to the other users?

In our opinion, something considerably better is needed now that such on-line file capacity is a reality, not that it wasn't desirable to have improved file management capabilities introduced from the very beginning, even before the advent of bigger disks. Now users will desperately need more capable file management in these newer systems, but doing so while retaining some sort of compatibility with the older generation of file management will be very awkward if not impossible in a practical sense.

Vendors who persist in offering only those file management facilities which were needed originally, even though they could have easily anticipated the changes which are occurring now, will result in dissatisfied customers—a consequence that could have been entirely avoided had those manufacturers planned properly.

The two-level directory. What things should one expect to see in an improved file management system? That which comes to mind first is the ability to create different file directories for each user of the system. The first level of the filing system contains information about each of the system users, while the second level has an individual directory for each user in which are recorded the names of the files "owned" by that user.

A file organization such as this is something that we take for granted in multi-terminal systems, though it may surprise some readers to find that not *every* multi-terminal system has such a filing system. In any case, having a two-level file directory system will be important even in stand-alone systems which may be occasionally used by a number of different users, each having files stored on a common Winchester disk.

The multi-level directory. By "multi-level" we mean anything that has more levels than the simple two-level directory scheme. For example, the ability for each user to create other directory "bins" or "filing drawers" within their own standard directory would permit them to aggregate together any material which is related, thereby segregating this material from other material which is independently aggregated, and so forth.

Given some practical experience with a system having essentially no limit to the number of sub-levels of file directories, we can caution that users sometimes do experience difficulty in remembering where they are in their file system. After working for several hours, they cannot always remember which file cabinet, and which file drawer within the cabinet, and which file folder within the drawer they are currently accessing.

Perhaps more common, and quite expectedly so, is getting "lost" when one is moving around within an unfamiliar filing structure. When that happens to a user, it is a strangely disconcerting experience to be lost in the maze of the filing system—the panic of the labyrinth temporarily overcomes the thinking process.

But don't let comments such as these discourage or dissuade you from seeing the virtues of a very flexible, multi-level file directory system. The need for more sophisticated methods of organizing documents will be more urgent as storage capacity increases.

The cross index. Something that is quite useful is a cross index. Basically it is a file that contains information about each file that is currently stored on disk. By defining certain search criteria, you will be able to find more easily the document that is mysteriously evading your efforts to locate it.

Besides the name of each document, the cross index might include some descriptive information such as important keywords and the like, and the author of the document, the names of people who have revised it or even people who have read it, the date and time the file was created, last accessed or printed, and many other things that one can foresee as being useful.

The archive index. When the number of documents becomes so extensive that some of them must be temporarily taken off-line to provide space for documents yet to be created, moving all information about these documents from the cross index to an archive index will still permit users to locate them as easily as if they were still on-line.

The comprehensive index. In fact, so long as the combination of the entries in the cross index and the archive index is not overwhelming, it is often more desirable to combine them into a single comprehensive index knowledgable about all documents ever created. In this way, the system provides the facility of a unified document preparation and information retrieval system.

The document journal. Given a very large system, in which many messages and documents are being distributed to various users of the system, the problem arises of how to eliminate many different copies of the same file. This problem currently pervades the world of paper-oriented offices, accounting for a prodigious amount of hard copy and considerable human effort in filing individual copies of documents in various physical locations throughout the company.

If a corporate communication system were to emulate the paper-oriented system, filing capacity would rapidly dwindle as many copies of the same document proliferated throughout the system. Therefore, some means must be found radically to improve this situation before it becomes extreme.

One possible solution might be the "document journal." Having deposited an "original" copy of a document in the journal, copies of it would be nothing more than references to that master copy rather than individual files each containing the text of that document. In fact, better document control would result since it would be possible to determine all people who currently have references to that document.

In the paper-oriented world, documents often get secondary and tertiary distribution after the original distribution. When trying to circulate a follow-up memorandum to *all* recipients, it is a painful process to determine manually once again all people who received the previous memorandum.

By contrast, on-line distribution is a considerably simpler task.

Some Final Observations

Beginning as we did with a preview of the kinds of technological changes that will occur to various kinds of memory devices during the 1980's, you can see that the result will entail considerable repercussions. But the most important thing is that these are essentially welcome changes.

Importantly, forward-thinking users must play an active role in shaping these systems through meaningful dialogue with the vendors. The difficulty that must be avoided at all costs stems from the possibility that systems may begin to look as if they were designed by a committee incapable of common assent as to the vital issues.

As manufacturers recognize that significant improvements in human productivity will result from the cogent introduction of more capable products based upon better storage and communications technology, and accept the responsibility of providing systems which incorporate better human engineering, the world of word processing systems will transcend into that of true information processing systems—like the awkward, many-legged caterpillar into the admirable winged butterfly.

Joseph L. Ehardt

The new Vydec 1800 looks just like the older Vydec 1400. It is essentially the same product, to which more memory has been added and for which "new" programs have been written.

THE WORD ON WP

Vydec 1800 Unveiled

Vydec has officially announced the 1800 system we mentioned in our "Product Alert" column last month. As we indicated, this new system appears to us to be a stop-gap measure designed to extend the life of Vydec's first generation hardware and to keep the company's existing and prospective customers from defecting while the development work on the promising 4000 continues.

Nevertheless, the 1800 is attractively priced at $13,700 for a dual floppy stand-alone system. It is compatible with other Vydec products. The 1800 will accept floppies from the older 1200 and 1400 systems, while information from the Vydec 2000 and 4000 editors (and presumably from communicating Qyxes) would be transmitted via communications. Telecommunications comes as a standard feature on the 1800, and includes the ability to interface with the Telex system, and with suitably programmed computers in addition to the Exxon family of products.

Basically, the 1800 is a Vydec 1400 to which a communications processor and a fair amount of random access memory have been added. In introducing the system Vydec is also announcing a set of "advanced software capabilities" that will run on the 1800. Vydec refers to this software as its Information Management System. It includes four distinct modules.

The first is an editing/formatting package which incorporates a couple of features that were missing in the original Text Editor software—automatic word wrap and global search and replace. The formatting capabilities (which were probably borrowed from Vydec's stand-alone Text Printer software) include some welcome features such as automatic repagination and automatic page numbering.

The second software module is a document assembly package (again reminiscent of Text Printer capabilities) that allows the operator to select and assemble paragraphs or documents and to merge letters with variable information. Variable information can also be rearranged in any order.

A records processing package constitutes the third program. This facility allows users to create, duplicate or update records of information and to retrieve selectively certain records based on selection criteria.

Finally, the new 1800 programs include a math package. This includes both a decimal tab feature (missing in Vydec's earlier systems) and a calculator capablity.

We expect that the 1800 will be most attractive as an upgrade option for existing Vydec 1200 or 1400 users, or as an auxiliary workstation to boost productivity in a word processing center with existing Vydec equipment.

R. C. Sanders Status Report

Although the Sanders printer, the Media 12/7, may not have made much of a dent in the U.S. word processing printer marketplace, it has certainly been responsible for a whole flurry of imitative activity by other printer manufacturers. However, chances are that none of the current imitators will be able to outdo Royden Sanders's patented "infinite matrix" principle of character formation *(see Vol. 2, No. 3, p. 14)*.

As we have pointed out before, one of the reasons that the versatile Sanders printer has not been generally ac-

R.C. Sanders Status Report (continued)

cepted as an attractive peripheral by most word processing system suppliers has to do with the amount of programming that would be required in the word processor front end to format information on the WP system's display as it will appear when output on the printer. Most word processing system suppliers appear to be still evaluating the feasibility of integrating the Sanders printer into their product lines, or are already embarked on their own printer development projects.

In addition to the evaluation units that Sanders has been selling to U.S. system suppliers, that company has enjoyed a major contract with the West German firm of Fleischhauer Datentraeger, a subsidiary of the Pelikan group. Under the agreement, Sanders has been supplying Fleischhauer with printers for sale to the European marketplace.

New word processing system. Sanders also contracted with Pelikan to develop a video terminal word processing system to go with the printer for sale to the European market. And the New Hampshire company has been looking for U.S. firms interested in licensing the word processing system for manufacture and sale to the U.S. market. The word processing system is nearing completion of its first phase which will result in a "shippable product." Further enhancements are still to come in further phases of the software development project.

Rocky relationship. However, the relationship with the German company seems to have soured recently. Sanders' latest vice president of marketing, Felix Hertzka, has left Sanders Technology and gone to work for the German firm, as has Sanders' chief financial person, former treasurer Richard Harrington. The two companies have announced that they are in the process of renegotiating both the sales and development agreements.

The West German firm apparently wants to alter the printer sales contract so that Sanders would deliver 3,000 printers a year for six years, instead of 6,000 printers a year for three years as had been previously agreed. In addition, Pelikan wants permission from Sanders to license a second source manufacturer for the printers starting in 1981, and the ability to purchase the above-mentioned printers from that source (probably a Pelikan subsidiary) rather than from Sanders directly. While Sanders Technology would still receive royalties on the printers produced under such an arrangement, it is clearly not as attractive an arrangement for Sanders over the short term.

Pelikan also wants to take over the development and production of the European word processor, leaving Sanders with the ability to make other manufacturing and marketing arrangements for the system in the U.S.

Recent financials. R.C. Sanders Technology recently announced its year-end financials with a loss of $2,254,258 on revenues of $2,026,418 as compared with fiscal 1978 losses of $953,072 on revenues of $497,031. President Royden Sanders attributed the loss to problems in gearing up printer production, most of which are behind the company. It was reported in February that Sanders had sold about 1,000 printers, 600 of them in Europe, and 400 to the U.S. and Canadian markets. Sanders has stated that the company has firm orders from North American buyers for 2,600 printers for the next twelve months in addition to the Fleischhauer arrangement.

A.B. Dick to Acquire Hendrix System

For about a year now, A.B. Dick has been marketing its Magna SL cluster word processing system. That product was developed by Hendrix Corporation, and was being supplied to A.B. Dick under an O.E.M. agreement. Now, the two companies have agreed that A.B. Dick should acquire all the rights to that product. A.B. Dick will therefore take over manufacturing and system development of the Magna SL in exchange for an undisclosed cash payment to Hendrix in addition to moderate royalties to be accrued over the next few years.

A.B. Dick has apparently already acquired a manufacturing and development facility near Hendrix in southern New Hampshire in order to make the transition as smooth as possible. Key Hendrix employees who have been involved with the word processing product will probably be offered jobs by A.B. Dick. However, Hendrix explains that there are plenty of opportunities at Hendrix for those who elect to remain with the company.

Hendrix Electronics will continue to produce and market its popular line of optical character readers (Typereaders) and the publishing systems for newspapers and in-plant use for which the company gained its reputation.

Inflation-Beating Opportunity

Yes, inflation has struck again. We are about to raise the subscription rate for *The Seybold Report on Word Processing* from $60 per year (twelve issues) to $72 per year. The cost for additional copies mailed in the same envelope will go from $48 to $54 for twelve issues.

However, we are going to give you an opportunity to beat inflation. If you call in and extend your subscription now (for one or two more years), or place your order for new or additional subscriptions right now, you may beat the rate hike. The deadline is April 30, 1980. All subscription renewals or new orders received after that date will be billed according to the new rates.

So if you have friends or associates who should be reading the *Report,* why don't you let them know about this opportunity to beat the rate increase. After all, as we're sure you'll agree, *The Seybold Report on Word Processing* packs a lot of value for the money—you will not find a more informative publication on word processing at twice the price (even at twice our new price!).

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Lexitron Adds Communications, New Software

Lexitron has introduced a broad set of telecommunications options for its VT1000 series products. The total offering includes six different communications capabilities: asynchronous point-to-point, asynchronous ASCII/TTY, 2741 protocol, 2780/3780 and bisynchronous point to point. All of the programs are stored on floppies (or on tape cassettes for the 1100 series machines) and are loaded into the memory of the terminal (replacing the word processing program). There are menus associated with each different option which guide the operator through the steps necessary to establish all of the communication parameters.

By way of background, Lexitron of course had many of these communications capabilities on its earlier 900-series systems, but up until now, the VT1000 series only supported asynchronous ASCII and point-to-point communications as well as TWX/Telex communications. This new offering adds the more sophisticated communication protocols to the VT1000 roster.

Pricing. In order to add any of these TC options to your VT 1000, you must purchase the communications hardware modification for $1200 (monthly lease price of $40) and then purchase whichever program(s) you need. Each of the asynchronous communications programs sells for $250, while the synchronous options are $300 each.

Functions. The asynchronous point to point mode is designed to permit communication among Lexitron systems at speeds up to 2400 bits per second (approximately 240 characters per second) in half or full duplex, a character at a time (conversational mode), a line at a time, or in a batch send mode.

Asynchronous ASCII is designed to be used when communicating with a computer system or to any teletype-oriented network. Again the user can customize the transmission parameters in terms of speed, mode of transmission, and specify particular code conventions to match the transmitting or receiving system. Maximum transmission speed is 2400 bits per second.

The 2741 protocol gives the user the ability to emulate an IBM 2741 terminal at speeds up to 1200 bits per second.

The binary synchronous 2780 and 3780 protocols are higher speed (up to 4800 bits per second or 480 characters per second) capabilities with more inherent error-checking than is the case with asynchronous forms of transmission. Both options allow the user to specify what speed, what codes, and in which mode the transmission will occur. In addition, the user specifies the data link control (which determines which system is transmitting or receiving), the block format (one or more records per transmission block), whether it is fixed or variable record length (up to 80 characters), and whether to transmit Job Control Language to the computer. The 3780 protocol also offers users the ability to receive information with more than 80 characters in a line, and economizes by compressing the transmission of space characters.

A bisynchronous point-to-point option is designed to allow two Lexitron systems to communicate with one another at speeds up to 4800 bits per second, and to transmit all characters that are displayable on the 1000's (including the special symbols) from one VT1000 to another.

Software enhancements. Other software enhancements introduced by Lexitron include a new math program. This package is available for VT 1200 and 1300 systems only (floppy disk systems), and costs $500. With the new program, operators can have the system automatically total and crossfoot columns of numbers. It will also calculate percentages, and store intermediate subtotals.

In addition to the math package, Lexitron has enhanced the VT1000's basic word processing software by adding automatic underscoring and double-underscoring, by delivering the concurrent print functions users had been expecting, and by adding a couple of other printer interface enhancements.

Raytheon/Lexitron Officially Launch RayText

At the Office Automation gathering in Atlanta March 3rd through the 6th, Raytheon Data Systems/Lexitron will unveil the "real" RayText. Readers will recall that the company demonstrated a prototype RayText system at last June's Syntopican exhibit. The product that the company is unveiling resembles that early version in that it combines both Lexitron's VT1000 terminals and RDS's PTS 1200 system.

However, instead of hooking stand-alone VT1000 systems up to a PTS 1200 distributed data processing system with its own data processing terminals, Raytheon/Lexitron have wound up with a far more integrated systems approach in which the system controller from Raytheon Data Systems (an RDS 1018) acts as the file manager and controller for a central repository of information (rigid disks with 10 or 65 million character capacity) to which up to ten VT1000 workstations may be attached. The 1000's still have their own floppy disks (one or two) for local file storage and archiving purposes.

So Raytext has emerged as a true distributed intelligence shared resource system which is similar to the CPT WordPak and Lanier Advanced Cluster system in concept, but which has at its kernel, a much more powerful central processor, file manager and communications controller. Raytheon has dubbed this approach "Distributed Office Systems Architecture" or "DOSA."

In addition to performing word processing functions, accessing a large data base of information and sharing peripherals and files, users at the word processing terminals will be able to transmit files via the central file controller to a large IBM or other mainframe using its 3270 communications capabilities. We anticipate that this DOSA environment will become the home for many more capabilities to come from Raytheon/Lexitron. We would expect to see the ability to use the 1000's not only as word processing terminals and as input and querying stations in a distributed data processing system, but we would also expect them to become fully user-programmable at some future point in time so that users could write their own special-purpose applications programs.

Citicorp's 'Executive' System Hits Market

Citibank has traditionally been one of the leading edge users in office automation equipment. Several years ago, the company embarked on an experiment to enhance executive productivity and to improve corporate communications by offering Digital Equipment Corporation word/data processing gear to a number of managers and their support personnel. As the task force assigned to oversee management automation gained experience with the DEC system, and experimented and evaluated many other alternatives, they came to the conclusion that nobody had yet designed the ideal system for the executive. The logical outcome of course was for Citibank to design its own system to meet its own set of specifications.

This project was undertaken in cooperation with a southern California company called Lexar Corporation. Lexar specializes in digital telephone branch exchange equipment, and since corporate communications were to be a focal point of the Citibank system that alliance made a lot of sense. It was Lexar Corporation which actually designed the system to be used by managers at Citibank, taking advantage of the digital communications products it had already developed, and integrating those into the word processing and office communications package Citibank had in mind.

No one really knows how much money Citicorp invested in the Lexar system. However, it is rumored to have been a great deal. At the beginning of last year, Citicorp finally acquired Lexar Corporation. In any event, the system was developed, produced and installed in Citibank in New York where it has been in use for well over a year.

The people at Citibank who were using the Lexar system and the project developers soon came to the conclusion that the system should not be a Citibank only product, but should be made available to the office automation marketplace generally. So, last summer, a new company, Lexar Business Communications, Inc. was created to begin manufacturing Lexar systems in earnest.

However, because of banking industry regulations, Citicorp could not be in the systems business *per se*, so they began to investigate alternatives for bringing the product to market. It was finally decided that a new company should be formed, in which Citicorp would be a substantial (but minority) investor. Other institutional investors chipped in. The new company is called Axxa Corporation and its charter is to produce and market the Lexar system. Axxa currently has offices in New York and Los Angeles.

System highlights. The Axxa system is actually designed to suit the requirements of a manager and his or her key support personnel. The systems are generally configured as two-terminal clusters, with one workstation in the manager's office and the other on the support person's desk. Local rigid disk storage is provided.

As we indicated, corporate communications is viewed as one of the strong suits of the Axxa system. It offers fairly comprehensive electronic mail and messaging features among Axxa users and also provides for access to outside data bases. The communications functions are designed to eliminate the tedium of manual or conventional message systems. The originator enters his or her communication, designates the recipient or the community of recipients and the Axxa system takes over.

It not only automatically dials the number and delivers the message, at the specified delivery time, but it will also continue to dial until it gets through to the recipient(s), and keep a log of any problems it encounters in carrying out its delivery assignments. The system will also make note of the date and time the message was received and will note the action taken upon receipt.

It is anticipated that managers and their staff will use their systems not only as corporate communications tools, but as data querying and problem-solving devices, by allowing access to the company's own mainframe computers and/or to outside data services via communications.

Other "executive" functions include an on-line calendar that can be used by the manager and support personnel to maintain accurate, up-to-the minute appointment scheduling. In addition, Axxa has the ability to produce basic business graphics, such as bar charts and block diagrams.

Many of the system's other features fall into the category of more or less standard word processing functions, which it is presumed would be most extensively used by a manager's support personnel, with letters and documents submitted for his or her on-line review and approval before printout.

The video terminals used in the system are quite impressive. They feature high-resolution full-page screens which not only display a full page of information in the vertical direction but which can be also be rotated 90° so the same terminal screen will display a wide-measure page horizontally without resorting to horizontal scrolling.

Cosmetically, the Axxa systems were designed to fit into the "executive suite" looking as little like computer systems as possible. In addition, a fair amount of attention was paid to concerns of noise, heat and other environmental considerations.

As this article went to press, we had not yet received word on pricing and availability for the Axxa system. We hope to provide further coverage in the next issue.

Letters

Compliments on Augment issue . . .

I very much enjoyed re-reading your well-researched and perceptive account of Augment in the October 1978 "Seybold Report on Word Processing." (For some reason, the old issue got circulated around our office recently.) I am one of those who had "withdrawal symptoms" when I left SRI and no longer had access to NCS.

Very truly yours,

R.C. Harkness
Satellite Business Systems
8003 Westpark Drive
McLean, Virginia 22102

. . . and Lanier

Your comprehensive reports on our No Problem typewriter and the No Problem Shared System were excellent. We appreciate the time you took to study both systems in such detail.

Sales of the newly introduced Shared System are well above our expectations. This, of course, concerns the favorable opinion you expressed in your November report.

Best regards,

Charles C. Hall
Lanier Business Products, Inc.
1700 Chantilly Drive, N.E.
Atlanta, Georgia 30324

New IBM Text Editing Software

At a Media Industry Data Processing Executives conference held in Hilton Head in mid-February, IBM unveiled a new text editing software package. The program is unusual in a couple of respects. First, it appears to be a very good editing package—a first for any division within IBM. And second, the capability was developed as a cooperative effort between IBM's Data Processing Division and that company's General Systems Division.

The text editing package, which is a Field Developed Program (FDP 5798 RAR) available from the General Systems Division to run on their Series/1 computers, was developed in response to the requirements of a particular group of customers in the broadcasting industry. GSD consulted with DPD's Distributed Office Systems Group (with its contingent of publishing systems specialists). DPD then undertook to design a general-purpose text editing package that would meet the needs of a broad range of customers needing interactive terminal editing capabilities. Once complete, the functional entry and editing program design was passed over to the General Systems Division group in Charlotte, North Carolina to be integrated into the Series/1 environment and "productized."

Text Editor vs. Word Processor. It is important to note that we (and IBM) have described this capability as a Text Editing Package rather than a word processing system. Although the program contains very powerful input and editing functions, it is not intended to be used as a typical office word processing system, nor does it have many of the features and functions generally associated with word processing (automatic letter writing, and so on). While the program handles input and editing, it is anticipated that the actual formatting of material for output to a quality printer would be handled by software within the printer itself, or by programs in another computer system.

At the Hilton Head demonstration, for example, the Series/1 Text Entry and Editing System was running on-line to an IBM 6670 laser printer, which formatted, justified and paginated the output as it printed. So, although the new Text Editing System is not appropriate for users desiring conventional word processing tools, it might fit the bill as an office editing system for applications involving heavy writing and revision of long documents to be produced by a laser printer or sent on to another word processing or typesetting facility.

Functions & features. The Series/1 Text Entry and Editing System runs on a standard Series/1 system under the EDX operating system and uses standard 4978 video display stations with modified keyboards. It will support about five video terminals and a printer in addition to both floppy and rigid disks. The editing program features virtual scrolling (the ability to scroll forward and backward through a document of any length), multiple windows or split-screen editing, and a large number of "save/get" areas.

The user can divide the screen into up to four "windows," each of which may contain a separate file. All editing functions (including scrolling) can be performed independently within each window, and blocks of text may be copied or moved from one window to another. There are two rows of keys along the top of the main alphanumeric keyboard. Seventeen of them are reserved for what IBM terms "streams" or what we would call "save/get" areas. These are "cubbyholes" into which users can stash strings of commands, blocks of copy, or entire files, for later recall and insertion. Each of those text "streams" stored and accessed under any of those keys may contain up to 180,000 characters of information.

Other editing functions include the ability to insert unlimited amounts of copy, search and replace, and block define, delete, copy, move and exchange, with no arbitrary restriction placed on the size of any defined element. There is also a "wastebasket" key that will restore inadvertently deleted material.

Configuration & pricing. If you already have a Series/1 System and want to acquire the Text Editing program, the Field Developed Program (FDP) is available for a one-time license fee of $2,880, or on a monthly fee basis for $240 per month. In addition, you would need to add the terminal keyboard enhancement to your 4978 display stations at a one-time cost of $1,130 per keyboard.

If you are starting from scratch, a typical system consisting of five VDT's, a Series/1 processor (with 256K of memory), a 9.5 million character rigid disk drive, and a host-connect facility for interconnection to a larger IBM mainframe, would cost $65,755.

In addition to "driving" the Office Products Division's 6670 printer, the Series/1 Text Editor can interface directly to an IBM 370 or 4331 mainframe, and is of course, programmable as a communications processor to interface with a variety of other systems.

Availability. The program is slated for customer delivery early this fall. It has been running in test sites, and can be demonstrated in GSD's Charlotte, North Carolina office.

User-customization. Although customers could choose to acquire and operate the Text Entry and Editing Program as a turn-key system, it is completely modifiable by the user. IBM supplies the source code with the programs, and users are encouraged either to use the general purpose editor and integrate it into their own applications software, and/or to modify the entry and editing functions to suit their preferences.